(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
13 December 2001 (13.12.2001)

PCT

(10) International Publication Number
WO 01/95495 A1

(51) International Patent Classification[7]: H03M 5/14, G11B 20/14

(21) International Application Number: PCT/EP01/05505

(22) International Filing Date: 11 May 2001 (11.05.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
00201952.9 2 June 2000 (02.06.2000) EP

(71) Applicant: KONINKLIJKE PHILIPS ELECTRONICS N.V. [NL/NL]; Groenewoudseweg 1, NL-5621 BA Eindhoven (NL).

(72) Inventors: KAHLMAN, Josephus, A., H., M.; Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL). SCHOUHAMER IMMINK, Kornelis, A.; Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL).

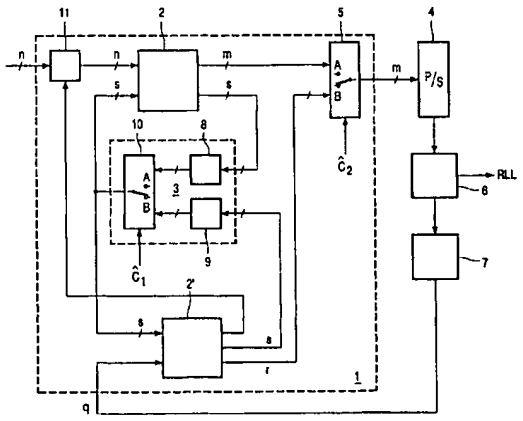
(74) Agent: DEGUELLE, Wilhelmus, H., G.; Internationasl Octrooibureau B.V., Prof Holstlaan 6, NL-5656 AA Eindhoven (NL).

(81) Designated States *(national)*: CN, JP, KR.

(84) Designated States *(regional)*: European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR).

Published:
— *with international search report*

(54) Title: DEVICE FOR ENCODING A STREAM OF DATABITS OF A BINARY SOURCE SIGNAL INTO A STREAM OF DATABITS OF A BINARY CHANNEL SIGNAL, MEMORY MEANS, DEVICE FOR RECORDING INFORMATION, RECORD CARRIER, DEVICE FOR CODING AND DEVICE FOR PLAYING BACK



(57) Abstract: In a device for encoding a stream of databits of a binary source signal into a stream of databits of a binary channel signal the bitstream of the source signal is divided into n-bit source words. The device comprises converting means adapted to convert a block of p consecutive n-bit source words into a corresponding block of p consecutive m-bit channel words, such that the conversion for at least most of the n-bit source words is parity preserving and/or parity inverting, where m>n≥1. The converting means comprise memory means which contain for each n-bit source word a number of m-bit channel words, arranged in coding states, and a corresponding state number, indicating the state for a next m-bit channel word. After each block of source words q dc-control sourcebits are added, which are converted into r dc-control channelbits, independent of the conversion of a following source word.

WO 01/95495 A1

Device for encoding a stream of databits of a binary source signal into a stream of databits of a binary channel signal, memory means, device for recording information, record carrier, device for coding and device for playing back

The present invention relates to a device for encoding a stream of databits of a binary source signal into a stream of databits of a binary channel signal, wherein the bitstream of the source signal is divided into n-bit source words, which device comprises converting means adapted to convert a block of p consecutive n-bit source words into a corresponding block of p consecutive m-bit channel words, where p, n, m are integers and $m>n\geq 1$, the converting means comprising memory means which contain for each n-bit source word a number of m-bit channel words, arranged in coding states, and a corresponding state number, indicating the memory location for a next m-bit channel word.

Such a device is known from WO97/09718/A1 and describes a recording and reproducing system, provided with a memory, which, in response to n-bit source words and respective table numbers, generates m-bit channel words and state numbers for next source word conversions. The conversions are not parity preserving. Further said known device comprises a selection circuit, which, in response to the m-bit channel words, calculates the running DSV (digital sum value) and provides for selection signals which indicate whether the read out channel words have to increase or decrease the DSV. Although by these measures the dc-level may be incidentally reduced, an overall dc-suppression is not guaranteed, with the consequence that still distortions may be introduced in communicating systems which cannot handle a dc-component, as well as distortions in any recording of data on respective carriers.

In order to obtain a required dc-suppression, dc-control bits can be introduced on source level, however, with the consequence that the channel words do not correspond with the source words any longer. This means that, when there is an error on a data carrier, error propagation during reproducing may occur.

Further, in practice several encoding systems are known, e.g. in CD-recording and reproducing systems EFM-encoding of 8-bit source words into 17-bit channel words is applied. During recording the encoded channel words are recorded on a data carrier, while during reproducing the channel words are decoded inversely. In DVD-recording and reproducing systems EFM-plus-encoding of 8-bit source words into 16-bit channel words is

applied. The channel signals therein are realized in a (2,10) sequence. However, in all these known systems a dc-suppression in the channel word sequence is not guaranteed.

Referring to the above it may be noticed that encoding devices in general provide for encoded channel words in a (d,k) sequence, wherein d is the number of 'zeros' which at least is present between two subsequent 'ones' in the serial datastream of the channel signal and k the number of 'zeros' which at most is present between two subsequent 'ones' in the serial datastream of the channel signal. The description in said international patent application shows a conversion of blocks of 8-bit source words into blocks of 15-bit channel words in a (2,14) sequence. Although, by the presence in the memory of several coding tables, the sequence of channel words obeys the d,k-constraints, a dc-suppression, as already mentioned, is not guaranteed, because the separate conversions of n-bit source words into m-bit channel words are not parity preserving.

The purpose of the invention is to obtain an encoding device as described in the opening paragraph in which a dc-suppression in the channel word sequence is guaranteed and in which, when there is an error on a data carrier, error propagation during reproducing is avoided.

Therefore, in a first embodiment according to the invention, the device as described in the opening paragraph is characterized in that the conversion for at least most of the n-bit source words is parity preserving and/or parity inverting and that after each block of source words q dc-control sourcebits are added, which dc-control sourcebits are converted into r dc-control channelbits. In a second embodiment according to the invention, the device is characterized in that the conversion for at least most of the n-bit source words is parity preserving and/or parity inverting an that after each block of source words q dc-control sourcebits are added, which dc-control sourcebits together with only a following n-bit source word is converted into a (r+m)-bit channelword, where q and r are integers. In both cases all the source words correspond with respective channel words; in other words, source words and channel words are permanently aligned with each other. By this measure error propagation will be avoided. As in the second embodiment a separate table is provided for the conversion of (n+q)-bit source words into (m+r)-bit channel words, which is more complicated than a simple table for the conversion of q-bit dc-control source bits into r dc-control channel bits, the first embodiment is preferred.

Although parity preserving codes are known per se, instead of a parity preserving conversion of source words into channel words, also a parity inverting conversion may be applied. The conversion is parity preserving when, if the number of 'ones' in a source

word is even, the number of 'ones' in a corresponding channel word is even too, and, if the number of 'ones' in a source word is odd, the number of 'ones' in a corresponding channel words is odd too. The conversion is parity inverting when, if the number of 'ones' in a source word is even, the number of 'ones' in a corresponding channel word is odd, and, if the number of 'ones' in a source words is odd, the number of 'ones in a corresponding channel words is even. In both cases the insertion of a dc-control bit provides for parity conversion

In both embodiments the channel output signal sequence supplied by the converting means may be fed to a precoder to determine a RLL (run length limited) output signal, which signal is supplied to a control signal generator to derive the dc-control bits. Such a feedback loop for a parity preserving code is described in e.g. US-A-5,477,222, wherein between successive groups of p consecutive n-bit source words parity preserving bits are inserted in such a way that channel words obtained thereafter do not correspond with source words any longer and propagation errors may occur.

Like source word-to-channel word conversions, the dc-control source bits-to-dc-control channel bits conversion will depend on the last m-bit channel word, determining the state of the dc-control channel bits. Therefore, according to the invention the memory means further contain for each q dc-control source bits and for each state number r dc-control channel bits and a corresponding state number, indicating the memory location for a next m-bit channel word .

In a practical embodiment n=8, m=15, q=1 and r=2, while p may be chosen dependent on the desired dc-suppression. With a conversion rate 8/15 each source byte will correspond to a 15-bit channelword in one of the tables in the memory means, independently of the dc-control bits inserted.

When in a (d,k) channel word sequence in said practical embodiment d=2 and, for example a source code in the preferred embodiment ends with "1", the dc-control bits will always be "00" as the next channel word may start with "1" and at least two zero's must be present between two "1's". This means that the control bits itself have no influence with respect to parity control. Therefore, in order to realize a parity control in this case and in suchlike cases, according to the invention, the device comprises inverting means, which, depending on a last preceding channelword and on the dc-control channelbits, provides for inversion of an odd number of bits of a following source word; i.e. the inversion of 1, 3, 5,. bits of a following source word. Such an inversion identifies dc-control source bit-to-dc control channel bit conversions with dc-control channel bits of the same parity, when the

following channel word is chosen from another coding state belonging to a respective source word.

As the various coding states in the memory means contain multiple used channel words, errors on a data carrier may occur, such that the source words to which the channel words refer during reproducing, are not unambiguously determined. Therefore, according to the invention, the channel words in the coding states refer substantially to a same source word.

The invention further relates to memory means with a coding table for application in a device described above. According to the invention, the coding state may contain 15-bit channel words to generate a parity preserving (2,14) sequence, or a parity preserving (2,13) sequence and even a (2,12) sequence. Although, in the latter case the k-constraint is further diminished, the disadvantage that only a small number of the 1024 source-to-channel conversions is not parity preserving must be accepted.

The invention also relates to a device for recording information, which device comprises an encoding device according as described before for converting a series of channel words representing the information into a modulated signal and means for recording an information pattern corresponding to said modulated signal on a record carrier. Apart from the specific encoding device, the recording device can be the same as described in the above mentioned WO97/09718/A1, the content of which document must be considered as inserted in the present specification.

The invention further relates to a record carrier on which a modulated signal is recorded, said signal comprising a series of channel words, obtained by encoding source words as described above.

Further, the invention relates to a device for decoding channel words into source words comprising converting means with memory means containing the same coding states as the memory means in the encoding device according to the invention; however, the coding states now are read out inversely. In connection therewith the invention also relates to a device for playing back the information on said record carrier comprising a reading arrangement for reading said record carrier and a decoding device mentioned above.

These and other aspects of the invention will be apparent from and elucidated with reference to the embodiment described hereinafter and illustrated in the accompanying drawing. In the drawing:

Fig. 1 shows blockschematically an encoding device according to the invention;

Fig. 2 shows a dc-control source bit-to- dc-control channel bit conversion table;

Figs. 3A-3H show the coding states for a (2,14) parity preserving channel signal sequence;

Fig. 4A-4H show the coding states for a (2,13) parity preserving channel signal sequence; and

Fig. 5A-5H show the coding states for a (2, 12) channel signal sequence, wherein most source word-to-channel word conversions are parity preserving.

Fig. 1 shows an encoding device, which can be considered as a modification of the coding device 140, described in the above mentioned WO97/09718/A1 and applied in a recording device and a decoding and play back device described too in said document. Therefore, the contents of said document must be considered as inserted in the present specification.

The encoding device comprises converting means 1, arranged for converting n-bit source words into m-bit channel words, present in different coding states in a memory 2. The coding states are indicated by s bits. The input signals of the memory 2 are formed by a n-bit source word and a s-bit coding state number, indicating the current coding state where the relevant channel word can be found. The output signals of the memory 2 are formed by a m-bit channel word and a s-bit coding state number, indicating the next coding state, i.e. the state where the next channel word, corresponding with the next source word, can be found. The next state number, supplied by the memory 2 is delivered to said memory via a buffer unit 3.

The m-bit channel words are supplied to a parallel-to-serial converter (P/S) 4 via a switching unit 5 described later on. The serial bit string from the parallel-to-serial converter 4 is supplied to a 1T-precoder 6, well known in the art. The output signal of the 1T-precoder 6 is applied to a control signal generator 7, which generates the control signal for the converting means 1, so as to insert after each block of p consecutive source words q dc-control source bits. The closed loop formed, formed by the converter means 1, the parallel-to-serial converter 4, the 1T-precoder 6 and the control signal generator 7 are well known in the

art, e.g. from US-A-5,477,222. The output signal of the device, supplied by the 1T-precoder is a RLL (run length limited) output signal.

The converting means 1 comprise a memory 2' for converting the q dc-control source bits into r dc-control channel bits, present in different coding states in the memory 2'. In practice the memories 2 and 2' are integrated and form one memory 2, 2'. The coding states again are indicated by s bits. The input signals of the memory 2' are formed by the q dc-control source bits and a s-bit coding state number, indicating the current coding state where the relevant dc-control channel bits can be found. The output signals of the memory 2' are formed by r dc-control channel bits and a s-bit coding state number, indicating the next coding state, i.e. the state where the next m-bit channel word, corresponding with the next n-bit source word, can be found. The next state number, supplied by the memory 2' is delivered to the memory 2 again via buffer unit 3.

The buffer unit 3 comprises a first and a second delay element 8 and 9 respectively and switching means 10 for passing either the next s state number bits from the memory 2 or the next s state number bits from the memory 2'. The switching means 10, as well as the switching means 5 are controlled by the timing unit (not indicated in the figure) of the device.

The invention will further been explained for an example wherein, each time after four (p=4) consecutive 8-bit source words (n=8) are converted into 15-bit channel words (n=15), a dc-control source bit (q=1) is converted into two dc-control channel bits (r=2) and wherein the memory 2 contains for each source word 4 possible channel words, arranged in state tables, indicated by a 2-bit state number (s=2) 1, 2, 3 or 4. When in the memory 2 a source word is converted into a channel word, the state number for the next conversion is read out too and supplied via delay element 8 and the switching means 10 with a conversion clock delay to the input bus of the memory 2, so that the channel word for the next conversion is determined. The switching means 10 are in the position A in fig. 1. The channel word from the memory 2 is converted in a serial bitstring via the switching means 5 in the position A. After this process is repeated four times and , therefore, 4 consecutive source words are converted, from the bitstring of the obtained consecutive channel words and via the 1T-precoder 6 and the control signal generator 7, a dc-control source bit "0" or "1" is generated and supplied to the memory 2'. As also the dc-control channel bits in the memory are dependent of the state number, the state number read out together with the last channel words indicates the state of the dc-control bit conversion. Therefore, the dc-control channel bits from memory 2 are supplied via delay element 8 and switching means 10 in the position

B to memory 2' too. Based on the dc-control source bit and the respective state number the dc-control channel bits are read out, together with the state number of the next source word conversion. The latter state number is supplied again to memory 2 via delay element 9, introducing a conversion clock delay, and the switching means 10 in the position B. The dc-control channel bits are supplied to the parallel-to-serial converter 4 via the switching means 5 in the position B. Then, again 4 consecutive source words are converted into 4 corresponding channel words, whereafter again a dc-control source word is converted into a dc-control channel word. The result is that constantly the source words are aligned with the corresponding channel bits, so that, when during recording of the channel words on a carrier or during reproducing from said carrier an error occurs, this error is restricted to only the source word, obtained after conversion of the channel word into said source during reproduction, and is not propagated to other source words reproduced.

An example of a dc-control bit conversion as registered in memory 2' is indicated in fig. 2. When a channel words ends with "1", the next state is state 1. Although depending on this state and the dc-control source bit "0" or "1" the dc-control channel bits would be determined, the (d,k) sequence constraint with d=2 requires at least two zero's after an one, so that in both cases the dc-control channel bits will be "00". Depending on the dc-control source bit the next state (2 or 3 in fig. 2) is read out. Because in both cases there is no parity difference in the dc-control channel bits, such a parity difference must be made on another way. To make a parity difference between the situations where the dc-control source bits are "0" or "1", according to the invention inverting means 11 are provided to convert an uneven number of source bits, preferably only one bit of the next source word. This bit-inverting control signal for the inverting means 11 is supplied by the memory 2' in response to a dc-control source bit "1" in state 1. When a channel word ends with two to eight zero's, the dc-control channel bits can be found in states 2 or 3. In each of these states the dc-control channel bits have different parity dependent on the dc-control source bit. Therefore no source bits are inverted. When a channel word ends with "10", the dc-control channel bits can be found in state 4. Although not absolute necessary in view of the d=2 constraint, in this case, independent of the dc-control source bit the dc-control channel bits are "00", while the next conversion must be found in states 2 and 3 respectively. Again, the difference between the situations where the dc-control source bit is "0" and "1" can be made by generating, in case the latter dc-control source bit is "1", a bit inverting control signal to invert a bit of the next source word. When a channel word ends with nine, ten or eleven zero's, the dc-control channel bits can also be found in state 4. In this case, independent of the dc-control source bit

the dc-control channel bits are "01 and 10" respectively, while the next conversion now must be found in states 1 and 4 respectively. As the latter dc-control channel bits have the same parity, the difference between the situations where the dc-control source bit is "0" and "1" can again be made by generating, in case the latter dc-control source bit is "1", a bit inverting control signal to invert a bit of the next source word. By the parity preserving property of the (d,k) code, a sign inversion of the outgoing bitstream during reproduction will occur. This, however, can be corrected easily because the combination of the dc-control channel bits and the last state number is unique.

The alignment of source words and channel words can be applied to several (d,k) codes. In the above bit sequence d=2. From WO97/09718/A1 a (2,14) bitsequence is known, however, without any parity preserving guarantee. By applying the invention it is possible to guarantee parity preserving in combination with alignment of source words and channel words. An example of such a code is given in figs. 3A-3H, which figure shows a (2,14) parity preserving code. As it is advantageous to restrict the k constraint as much as possible and to realize state tables, wherein multiple used channel words refer to a same source word as much as possible, a (2,13) parity preserving code has been found. This code is indicated in figs. 4A-4H. When identical channel words refer to different source words and an error in the state number indication occurs, during reproduction the wrong source word is obtained and possibly the wrong state number for the next channel word-tot source word conversion. This results in another type of error propagation. In the above (2,13) code these errors are strongly reduced. Even a (2,12) code was found, wherein most of the 1024 source-to-channel conversions are parity preserving. Such a code is indicated in figs. 5A-5H; in that code only 10 of the $4x2^8$ conversions are not parity preserving.

CLAIMS:

1. Device for encoding a stream of databits of a binary source signal into a stream of databits of a binary channel signal, wherein the bitstream of the source signal is divided into n-bit source words, which device comprises converting means adapted to convert a block of p consecutive n-bit source words into a corresponding block of p consecutive m-bit channel words, where p, n, m are integers and $m>n\geq 1$, the converting means comprising memory means which contain for each n-bit source word a number of m-bit channel words, arranged in coding states, and a corresponding state number, indicating the coding state for a next m-bit channel word, characterized in that the conversion for at least most of the n-bit source words is parity preserving and/or parity inverting, and that after each block of source words q dc-control sourcebits are added, which dc-control sourcebits are converted into r dc-control channelbits, independent of the conversion of a following source word, where q and r are integers.

2. Device for encoding a stream of databits of a binary source signal into a stream of databits of a binary channel signal, wherein the bitstream of the source signal is divided into n-bit source words, which device comprises converting means adapted to convert a block of p consecutive n-bit source words into a corresponding block of p consecutive m-bit channel words, where p, n, m are integers and $m>n\geq 1$, the converting means comprising memory means which contain for each n-bit source word a number of m-bit channel words, arranged in coding states, and a corresponding state number, indicating the coding state for a next m-bit channel word, characterized in that the conversion for at least most of the n-bit source words is parity preserving and/or parity inverting, and that after each block of source words q dc-control sourcebits are added, which dc-control sourcebits together with only a following n-bit source word is converted into a (r+m)-bit channelword, where q and r are integers.

3. Device according to claim 1 or 2, characterized in that the channel output signal sequence supplied by the converting means is fed to a precoder to determine a RLL

(run length limited) output signal, which signal is supplied to a control signal generator to derive the dc-control bits.

4. Device according to any one of the claims 1-3, characterized in that the memory means further contain for each q dc-control source bits and for each state number, r dc-control channel bits and a corresponding state number, indicating the memory location for a next m-bit channel word .

5. Device according to any one of the preceding claims, characterized in that n=8, m=15, q=1 and r=2, while p is chosen dependent on the desired dc-suppression.

6. Device according to any one of the preceding claims, characterized in that the device comprises inverting means, which, depending on a last preceding channelword, the state number read out together with said last preceding channelword and on the dc-control channel bits, can provide for inversion of an odd number of bits of a following source word.

7. Device according to any one of the preceding claims, characterized in that multiple used channel words in the coding states refer substantially to a same source word.

8. Memory means with coding states for application in a device according to any one of the preceding claims, characterized by 15-bit channel words in a parity preserving (2,14) sequence.

9. Memory means with coding states for application in a device according to any one of the preceding claims, characterized by 15-bit channel words in a parity preserving (2,13) sequence.

10. Memory means with coding states for application in a device according to any one of the preceding claims, characterized by 15-bit channel words in a (2,12) sequence, while most of the 1024 source-to-channel conversions are parity preserving.

11. Device for recording information, which device comprises an encoding device according to any one of the claims 1-7 for converting a series of channel words representing

the information into a modulated signal and means for recording an information pattern corresponding to said modulated signal on a record carrier.

12. Record carrier on which a modulated signal is recorded, said signal comprising a series of channel words, obtained by encoding source words according to any one of the claims 1-7.

13. Device for decoding channel words into source words comprising converting means with memory means containing the same coding states as the memory means in claim 1 or 2, which coding states are read out inversely.

14. Device for playing back comprising a reading arrangement for reading a record carrier according to claim 12 and a decoding device according to claim 13.

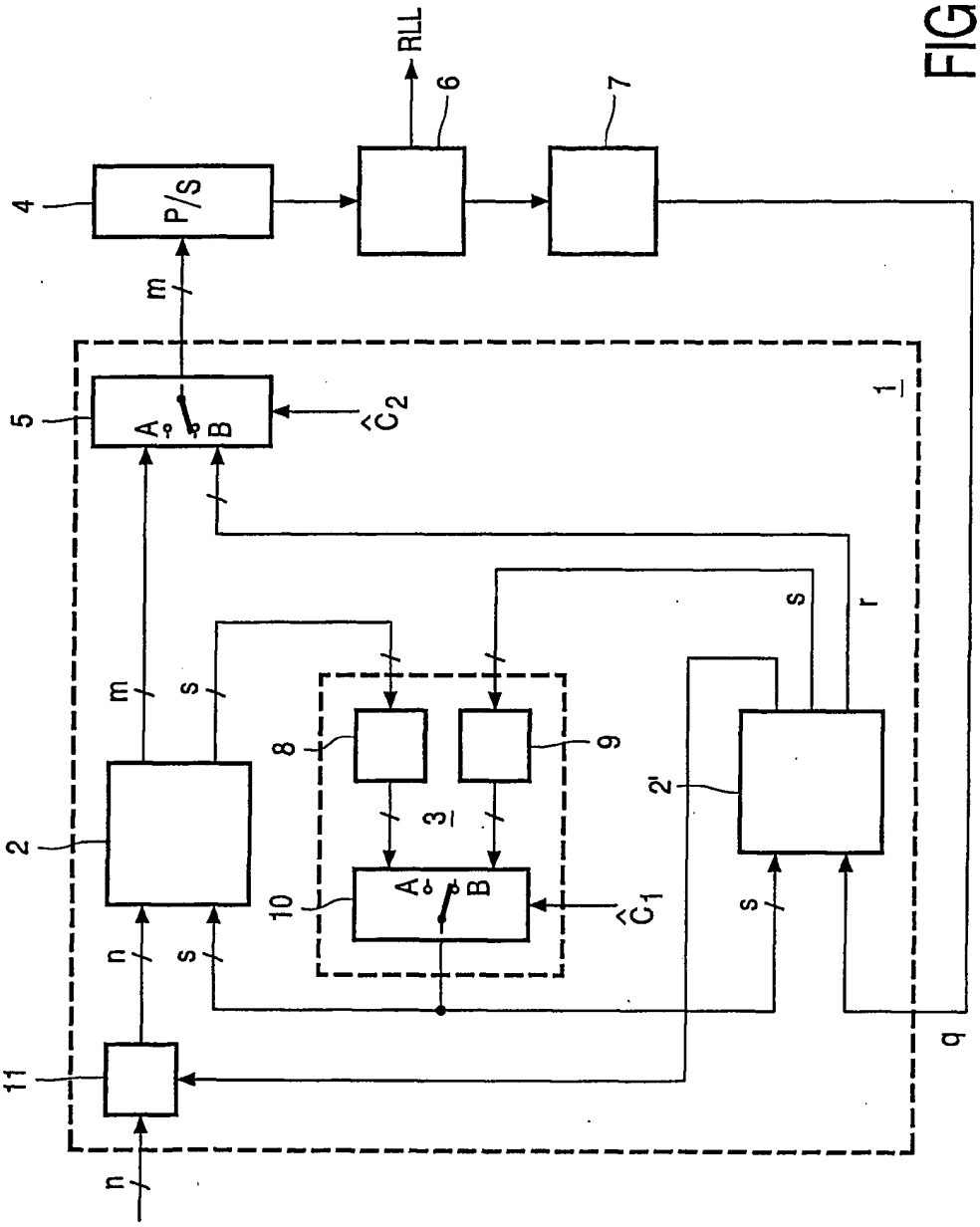


FIG. 1

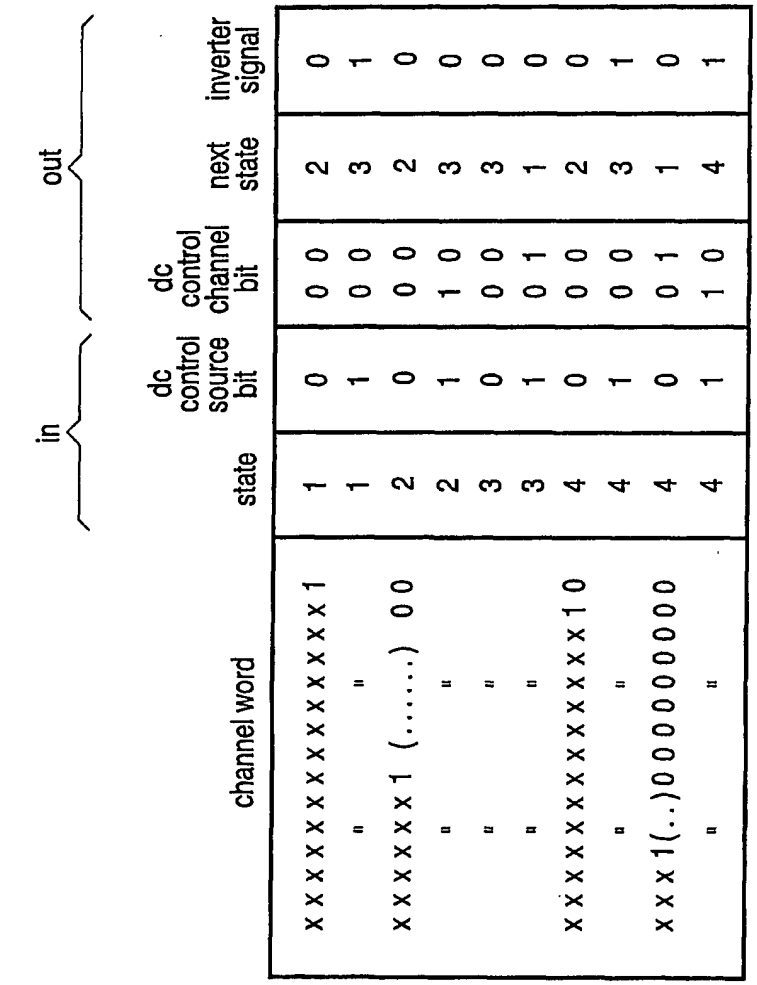

in
out
channel word
state
dc control source bit
dc control channel bit
next state
inverter signal
X X X X X X X X X X X X X 1
" 1 1 0 0 3 1
X X X X X X 1 (. . . . .) 0 0
" 2 1 1 0 3 0
" 3 0 0 0 3 0
" 3 1 0 1 1 0
X X X X X X X X X X X X 1 0
" 4 0 0 0 2 0
" 4 1 0 0 3 1
X X X 1(. .)0 0 0 0 0 0 0 0
" 4 0 0 1 1 0
" 4 1 1 0 4 1

FIG. 2

0	000100010010001	1	1000000010010001	1	000100100010001	1	000100010010001	1
1	000100000001001	1	1000000000001001	1	000000100001001	1	000100000001001	1
2	001000000001001	1	1001001000010001	1	000001000001001	1	001000000001001	1
3	000100100100001	1	1000001001000001	1	000100100100001	1	000100100100001	1
4	001001001001001	1	1000010010010001	1	000010000001001	1	001001001001001	1
5	000100001001001	1	1000000010010001	1	010001000010001	1	000100001001001	1
6	000100010001001	1	1000000100010001	1	010001000100001	1	000100010001001	1
7	000100000100100	2	1000100100010001	1	000100000001001	1	000100000100100	2
8	000100001000100	2	1000100010010001	1	000100000100001	1	000100001000100	2
9	000100100001001	1	1000001000010001	1	000001001001001	1	000100100001001	1
10	000100100010001	1	1000010000010001	1	000010010010001	1	000100100010001	1
11	000100001001000	2	1000100100010001	1	000100001000001	1	000100001001000	2
12	001000010010001	1	1000010000100001	1	010010000100001	1	001000010010001	1
13	000100010000100	2	1001000000000001	1	000100010000001	1	000100010000100	2
14	000100010001000	2	1001000010010001	1	000100100000001	1	000100010001000	2
15	001000100100001	1	1000010001000001	1	000010001001001	1	001000100100001	1
16	000100010010000	2	1001000100010001	1	010000000001001	1	000100010010000	2
17	001000001001001	1	1000100000010001	1	000010010001001	1	001000001001001	1
18	001000010001001	1	1000100000100001	1	000100010010001	1	001000010001001	1
19	000100100000100	2	1001000100010001	1	010000000010001	1	000100100000100	2
20	001000100001001	1	1001000000010001	1	000100001001001	1	001000100001001	1
21	000100100001000	2	1001001000010001	1	010000000100001	1	000100100001000	2
22	000100100010000	2	1001001001000001	1	010000001000001	1	000100100010000	2
23	001000100010001	1	1001000000010001	1	000100010001001	1	001000100010001	1
24	001001000001001	1	1001000001000001	1	000100100001001	1	001001000001001	1
25	000100100100000	2	0010000000001001	1	010000010000001	1	000100100100000	2
26	001000000100100	2	0010000000010001	1	010000100000001	1	001000000100100	2
27	001001000010001	1	1001000010000001	1	010000000000001	1	001001000010001	1
28	001000001000100	2	0010000000100001	1	010001000000001	1	001000001000100	2
29	001001000100001	1	1001000100000001	1	010000001001001	1	001001000100001	1
30	001001001000001	1	1001001000000001	1	010000010001001	1	001001001000001	1
31	001000001001000	2	0010000001000001	1	010001001001001	1	001000001001000	2

FIG. 3A

32	0010000010000100	2	0010000010000001	1	0100100000000001	1	0010000010000100	2
33	0001000000000100	2	0010000000000001	1	0100000010010001	1	0001000000000100	2
34	0001000000001000	2	0010000001001001	1	0100001000010001	1	0001000000001000	2
35	0010000010001000	2	0010001000000001	1	0100100010010001	1	0010000010001000	2
36	0001000000010000	2	0010000010001001	1	0100001000100001	1	0001000000010000	2
37	0010000010010000	2	0010010000000001	1	0100100100010001	1	0010000010010000	2
38	0010001000000100	2	0010010010010001	1	0100100100100001	1	0010001000000100	2
39	0001000001000000	2	0010000100100001	1	0100001000010001	1	0001000001000000	2
40	0001000010000000	2	0010001000010001	1	0100010000010001	1	0001000010000000	2
41	0010001000010000	2	1000000000100100	2	0000001000000000	2	0010001000010000	2
42	0010001000100000	2	1000000001000100	2	0000001001001000	2	0010001000100000	2
43	0001000100000000	2	0010001000100001	1	0100010010000001	1	0001000100000000	2
44	0010001001000000	2	1000000010010000	2	0000010001001000	2	0010001001000000	2
45	0001001000000000	2	0010001001000001	1	0100100000010001	1	0001001000000000	2
46	0001001001001000	2	0010010000010001	1	0100100000100001	1	0001001001001000	2
47	0010010000001000	2	1000000100001000	2	0000010010000100	2	0010010000001000	2
48	0010000000001000	2	0010010000100001	1	0100100010000001	1	0010000000001000	2
49	0010010000010000	2	1000000100010000	2	0000010010010000	2	0010010000010000	2
50	0010010000100000	2	1000000100100000	2	0000100001001000	2	0010010000100000	2
51	0010000000010000	2	0010010001000001	1	0100100100000001	1	0010000000010000	2
52	0010010001000000	2	1000001000001000	2	0000100010000100	2	0010010001000000	2
53	0010000000100000	2	0010010010000001	1	0000001000001000	2	0010000000100000	2
54	0010000001000000	2	1000000000001000	2	0000001000010000	2	0010000001000000	2
55	0010010010000000	2	1000001000010000	2	0000100010010000	2	0010010010000000	2
56	0001000001001000	3	1000001000100000	2	0000100100001000	2	0001000001001000	3
57	0010000010000000	2	1000000000010000	2	0000001000100000	2	0010000010000000	2
58	0010000100000000	2	1000000000100000	2	0000001001000000	2	0010000100000000	2
59	0001000010001000	3	1000001001000000	2	0000100100010000	2	0001000010001000	3
60	0010001000000000	2	1000000001000000	2	0000010000001000	2	0010001000000000	2
61	0001000010010000	3	1000010000001000	2	0000100100100000	2	0001000010010000	3
62	0001000100001000	3	1000010000010000	2	0001000001001000	2	0001000100001000	3
63	0010001001001000	2	1000000010000000	2	0000010000010000	2	0010001001001000	2

FIG. 3B

64	0001000010001000	3	1000001000010000	2	0001000001000100	2	0001000010001000	3
65	0010010000100100	2	1000000010000000	2	0000010000010000	2	0010010000100100	2
66	0010010010000100	2	1000000100000000	2	0000010000100000	2	0010010010000100	2
67	0001000010010000	3	1000001000100000	2	0001000001001000	2	0001000010010000	3
68	0010010010010000	2	1000000100100100	2	0000010010000000	2	0010010010010000	2
69	0001001000000100	3	1000001001000000	2	0001000010000100	2	0001001000000100	3
70	0001001000001000	3	1000010000000100	2	0001000010001000	2	0001001000001000	3
71	0001000000000100	3	1000001000100100	2	0000010000000100	2	0001000000000100	3
72	0001000000001000	3	1000001001000100	2	0000010000001000	2	0001000000001000	3
73	0001001000010000	3	1000010000001000	2	0001000010010000	2	0001001000010000	3
74	0001001000100000	3	1000010000010000	2	0001001000000100	2	0001001000100000	3
75	0001000000010000	3	1000001001001000	2	0000010000010000	2	0001000000010000	3
76	0010000000100100	3	1000010000100000	2	0001001000001000	2	0010000000100100	3
77	0001000000100000	3	1000010000100100	2	0000010000100000	2	0001000000100000	3
78	0001000001000000	3	1000010001000100	2	0000010001000000	2	0001000001000000	3
79	0010000001000100	3	1000010001000000	2	0001001000100000	2	0010000001000100	3
80	0001000010000000	3	1000010001001000	2	0000010010000000	2	0001000010000000	3
81	0010000001001000	3	1000010010000000	2	0001001001000000	2	0010000001001000	3
82	0010000010000100	3	1001000000000100	2	0100000001000100	2	0010000010000100	3
83	0001001000000000	3	1000010010000100	2	0001000000000100	2	0001001000000000	3
84	0010000010001000	3	1001000000001000	2	0100000010000100	2	0010000010001000	3
85	0001001001001000	3	1000010010001000	2	0001000000001000	2	0001001001001000	3
86	0010000000000100	3	1000010010010000	2	0001000000010000	2	0010000000000100	3
87	0010000010010000	3	1001000000010000	2	0100000010010000	2	0010000010010000	3
88	0010001000000100	3	1001000001000000	2	0100000100000100	2	0010001000000100	3
89	0010000000001000	3	1001000001001000	2	0001000001000000	2	0010000000001000	3
90	0010000000100000	3	1001000010000100	2	0001000010000000	2	0010000000100000	3
91	0010001000010000	3	1001000010010000	2	0100000100010000	2	0010001000010000	3
92	0010000000100000	3	1001000010010000	2	0001000100000000	2	0010000000100000	3
93	0010001000100000	3	1001000100000000	2	0100000100100000	2	0010001000100000	3
94	0010001001000000	3	1001001000000000	2	0100001000001000	2	0010001001000000	3
95	0010000010000000	3	1001000100000100	2	0001001000000000	2	0010000010000000	3

FIG. 3C

96	0010000010000000	3	1001000010001000	2	0001001001001000	2	0010000010000000	3
97	0010001000000100	3	1001001001001000	2	0100001000010000	2	0010001000000100	3
98	0010001000001000	3	0010000001001000	2	0100001000100000	2	0010001000001000	3
99	0010001000000000	3	1001000100100000	2	0100000000001000	2	0010001000000000	3
100	0010001000010000	3	0010000010001000	2	0100001001000000	2	0010001000010000	3
101	0010001001001000	3	1001001000000100	2	0100000000010000	2	0010001001001000	3
102	0010001000100100	3	1001001000010000	2	0100000000100000	2	0010001000100100	3
103	0010001000100000	3	0010000010010000	2	0100010000000100	2	0010001000100000	3
104	0010001001000000	3	0010000100001000	2	0100010000010000	2	0010001001000000	3
105	0010001001000100	3	1001001000100000	2	0100000001000000	2	0010001001000100	3
106	0010001001001000	3	1001001001000000	2	0100000010000000	2	0010001001001000	3
107	0001000000000000	4	0010000100001000	2	0100010000100000	2	0001000000000000	4
108	0001000000000010	4	0010000000000100	2	0100000100000000	2	0001000000000010	4
109	0001000000100100	4	0010000100100000	2	0100010001000000	2	0001000000100100	4
110	0001000001000010	4	0010001000001000	2	0100010010000000	2	0001000001000010	4
111	0001000100100100	4	0010000000010000	2	0100001000000000	2	0001000100100100	4
112	0001000010000010	4	0010001000010000	2	0100100000000100	2	0001000010000010	4
113	0001001000100100	4	0010000000100000	2	0100001001001000	2	0001001000100100	4
114	0001001001000010	4	0010000001000000	2	0100010001001000	2	0001001001000010	4
115	0001000100000010	4	0010001000100000	2	0100100000010000	2	0001000100000010	4
116	0010000000000010	4	0010000010000000	2	0100010010001000	2	0010000000000010	4
117	0001001000000010	4	0010001001000000	2	0100100000100000	2	0001001000000010	4
118	0010000000100100	4	0010010000001000	2	0100100001000000	2	0010000000100100	4
119	0010000100100100	4	0010000100000000	2	0100010010001000	2	0010000100100100	4
120	0010001000100100	4	0010001000000000	2	0100100001001000	2	0010001000100100	4
121	0010000000100010	4	0010010000001000	2	0100100010000000	2	0010000000100010	4
122	0010000010000010	4	0010010000100000	2	0100100100000000	2	0010000010000010	4
123	0010001001000100	4	0010001001001000	2	0100100010001000	2	0010001001000100	4
124	0010000100000010	4	0010010001000000	2	0000001000000000	3	0010000100000010	4
125	0010010000000000	4	0010010000100100	2	0100100010010000	2	0010010000000000	4
126	0010010000100100	4	0010010010000100	2	0100100100000100	2	0010010000100100	4
127	0010001000000010	4	0010010010000000	2	0000001001001000	3	0010001000000010	4

FIG. 3D

128	001001000000010	4	100000000100100	3	000001000100100	3	001001000000010	4
129	001001000100010	4	001001001001000	2	010010010001000	2	001001000100010	4
130	001001001000010	4	100000000000100	3	010010010010000	2	001001001000010	4
131	000000000010000	3	100000001000100	3	000001001000100	3	010001001001001	1
132	000000000100100	3	100000000001000	3	000000100000100	3	010000000000100	3
133	000000000100000	3	100000001001000	3	000001001001000	3	010000000100100	3
134	000000001000000	3	100000010000100	3	000010000100100	3	010000001000100	3
135	000000001000100	3	100000000010000	3	000000100001000	3	010000000001000	3
136	000000001001000	3	100000000100000	3	000000100010000	3	010000000010000	3
137	000000010000000	3	100000010001000	3	000010001000100	3	010000001001000	3
138	000000100000000	3	100000010010000	3	000010001001000	3	010000010000100	3
139	000000010000100	3	100000001000000	3	000000100100000	3	010000000100000	3
140	000000100100100	3	100000100000100	3	000010010000100	3	010000010001000	3
141	000000010001000	3	100000010000000	3	000001000000100	3	010000001000000	3
142	000000010010000	3	100000100000000	3	000001000001000	3	010000010000000	3
143	000001000100100	3	100000100001000	3	000010010001000	3	010000010010000	3
144	000000100000100	3	100000100100100	3	000001000010000	3	010000100000000	3
145	000001001000100	3	100000100010000	3	000010010010000	3	010000100000100	3
146	000001001001000	3	100000100100000	3	000100000100100	3	010000100001000	3
147	000000100001000	3	100001000100100	3	000001000100000	3	010000100100100	3
148	000010000100100	3	100001000000100	3	000100001000100	3	010000100010000	3
149	000000100010000	3	100001001000100	3	000001001000000	3	010001000100100	3
150	000000100100000	3	100001001001000	3	000010000000100	3	010001001000100	3
151	000010001000100	3	100001000001000	3	000100001001000	3	010000100100000	3
152	000010001001000	3	100001000010000	3	000100010000100	3	010001000000100	3
153	000001000000100	3	100010000100100	3	000010000001000	3	010001001001000	3
154	000001000001000	3	100010001000100	3	000010000010000	3	010010000100100	3
155	000010010000100	3	100001000100000	3	000100010001000	3	010001000001000	3
156	000001000010000	3	100010001001000	3	000010000100000	3	010010001000100	3
157	000010010001000	3	100001001000000	3	000100010010000	3	010001000010000	3
158	000010010010000	3	100010000000100	3	000100100000100	3	010001000100000	3
159	000001000100000	3	100010010000100	3	000010001000000	3	010010001001000	3

FIG. 3E

160	000001001000000	3	100010010001000	3	000010010000000	3	010000100000000	2
161	000000100100100	2	100010000001000	3	000100100001000	3	010001001000000	3
162	000001000100100	2	100010000010000	3	000100100010000	3	010010000000100	3
163	000010000000100	3	100010010010000	3	000100000000100	3	010000000010000	2
164	000001001000100	2	100010000100000	3	000100100100000	3	010010000001000	3
165	000010000001000	3	100100000100100	3	000100000001000	3	010000001000000	2
166	000010000010000	3	100100001000100	3	000100000010000	3	010000000000100	2
167	000001001001000	2	100010001000000	3	010000000100100	3	010010000010000	3
168	000010000100100	2	100010010000000	3	010000001000100	3	010010000100000	3
169	000010000100000	3	100100001001000	3	000100000100000	3	010000000001000	2
170	000010001000000	3	100100010000100	3	000100001000000	3	010000000100000	2
171	000010001000100	2	100100000000100	3	010000001001000	3	010010001000000	3
172	000010010000000	3	100100010001000	3	000100010000000	3	010000010000000	2
173	000010001001000	2	100100000001000	3	010000010000100	3	010010010000000	3
174	000010010000100	2	100100000010000	3	010000010001000	3	010000010001000	2
175	000000100100000	2	100100010010000	3	000100100000000	3	010000100100100	2
176	000010010001000	2	100100000100000	3	010000010010000	3	010000010010000	2
177	000001000000100	2	100100100000100	3	000100100100100	3	010001000100100	2
178	000001000001000	2	100100100001000	3	010000000000100	3	010001001000100	2
179	000010010010000	2	100100001000000	3	010000100000100	3	010000100000100	2
180	000001000010000	2	100100100010000	3	010000000001000	3	010000010001001	1
181	000000001001001	1	100100010000000	3	010000100001000	3	010000100001000	2
182	000000010001001	1	100100100000000	3	010000100010000	3	010000100010000	2
183	000001000100000	2	100100100100000	3	010000000010000	3	010000010010001	1
184	000001001000000	2	001000000000100	3	010000000100000	3	010000100010001	1
185	000000010010001	1	100100100100100	3	010000100100000	3	010000000100100	2
186	000000100001001	1	001000000100100	3	010001000000100	3	010000001001000	2
187	000010000000100	2	001000000001000	3	010000001000000	3	010010000010001	1
188	000000100010001	1	001000001000100	3	010001000001000	3	010000010000100	2
189	000010000001000	2	001000000010000	3	010000010000000	3	010001000001001	1
190	000010000010000	2	001000000100000	3	010000100000000	3	010001000010001	1
191	000000100100001	1	001000001001000	3	010001000010000	3	010000001000100	2

FIG. 3F

192	000010000100000	2	001000001000000	3	010000100100100	3	010000000000001	1
193	000001000001001	1	001000010000100	3	010001000100000	3	010000100100000	2
194	000001000010001	1	001000010001000	3	010001001000000	3	010001000000100	2
195	000010001000000	2	001000010000000	3	010001000100100	3	010000100001001	1
196	000001000100001	1	001000010010000	3	010010000000100	3	010001000001000	2
197	000010010000000	2	001000100000000	3	010001001000100	3	010010000001001	1
198	000000001000001	1	001000100100100	3	010001001001000	3	010000001001001	1
199	000001001000001	1	001000100000100	3	010010000001000	3	010000001000001	1
200	000010000001001	1	001000100001000	3	010010000010000	3	010000010000001	1
201	000000010000001	1	001001000100100	3	010010000100100	3	010010000100001	1
202	000000100000001	1	001001001000100	3	010010001000100	3	010010001000001	1
203	000010000010001	1	001000100010000	3	010010000100000	3	010000100000001	1
204	000001000000001	1	001001001001000	3	010010001001000	3	010010010000001	1
205	000010000100001	1	001000100100000	3	010010001000000	3	010010001001001	1
206	000010001000001	1	001001000000100	3	010010010000000	3	010001000000001	1
207	000001001001001	1	100000000000010	4	010010010000100	3	010000100100001	1
208	000010010000001	1	001001000001000	3	000000100010010	4	010010010001001	1
209	000010000000001	1	100000010010010	4	010010010001000	3	010001000100001	1
210	000010001001001	1	100000100010010	4	010010010010000	3	010000000000010	4
211	000000000000010	4	001001000010000	3	000000100100010	4	010010000000001	1
212	000000000010010	4	100000100100010	4	000000100000010	4	010000010010010	4
213	000000010010010	4	001001000100000	3	000001000000000	4	010000000010010	4
214	000000100010010	4	001001001000000	3	000001000010010	4	010000000100010	4
215	000000000100010	4	100001000000000	4	000001000000010	4	010000100010010	4
216	000000001000010	4	100001000010010	4	000010000000010	4	010000100100010	4
217	000000100100010	4	100000000010010	4	000001000100010	4	010000001000010	4
218	000001000000000	4	100000000100010	4	000001001000010	4	010000010000010	4
219	000000010000010	4	100001000100010	4	000010010010010	4	010001000000000	4
220	000001000010010	4	100000001000010	4	000010000000000	4	010000100000010	4
221	000000100000010	4	100001001000010	4	000100000000010	4	010001000010010	4
222	000001000000010	4	100010000000000	4	000100010010010	4	010001000100010	4
223	000001000100010	4	100000010000010	4	000010000010010	4	010001000000010	4

FIG. 3G

224	000001001000010	4	100000100000010	4	000010000100010	4	010010000000010	4
225	000010000000010	4	100010000010010	4	000100100010010	4	010001001000010	4
226	000010010010010	4	100010000100010	4	000100100100010	4	010010000000000	4
227	000010000000000	4	100001000000010	4	000010001000010	4	010010010010010	4
228	000010010001001	1	100010001000010	4	010000000000010	4	010010000010010	4
229	000010000010010	4	100010000000010	4	000010010000010	4	010000000001001	1
230	000010000100010	4	100010010010010	4	000100000000000	4	010010010010001	1
231	000010010010001	1	100010010000010	4	010000010010010	4	010010000100010	4
232	000000000001001	1	100100000000000	4	010000100010010	4	010010001000010	4
233	000010001000010	4	100100000000010	4	000100000010010	4	010000000010001	1
234	000010010000010	4	100100010010010	4	000100000100010	4	010000000100001	1
235	000000000010001	1	100100000010010	4	010000100100010	4	010010010000010	4
236	000000000000001	1	100100100010010	4	000100001000010	4	010001001000000	2
237	000000000100001	1	100100000100010	4	010001000000000	4	010001001000001	1
238	000000000100100	2	100100001000010	4	010001000010010	4	010010010001000	3
239	000000000000100	2	100100100100010	4	000100010000010	4	010001000010000	2
240	000000001000100	2	100100010000010	4	010001000100010	4	010010010010000	2
241	000000000001000	2	001000000010010	4	000100100000010	4	010010000000100	2
242	000000000010000	2	001000000100010	4	010000000010010	4	010010000010000	2
243	000000001001000	2	100100100000010	4	010001001000010	4	010001001001000	2
244	000000000100000	2	001000001000010	4	010000000100010	4	010010000100000	2
245	000000010000100	2	001000000000010	4	010010000000000	4	010010000100100	2
246	000000010001000	2	001000010010010	4	010010000010010	4	010010001000100	2
247	000000001000000	2	001000010000010	4	010000001000010	4	010001000100000	2
248	000000010000000	2	001000100000010	4	010000010000010	4	010010010000000	2
249	000000010010000	2	001000100010010	4	010010000100010	4	010010001001000	2
250	000000100000100	2	001000100100010	4	010010001000010	4	010010010000100	2
251	000000100000000	2	001001000000010	4	010000100000010	4	010010000001000	2
252	000000100001000	2	001001000000000	4	010010010000010	4	010010010001000	2
253	000000000000100	3	100000000010001	1	010001000000010	4	010010001000000	2
254	000100000010001	1	100000000100001	1	010010000000010	4	000100000010001	1
255	000000100010000	2	001001000010010	4	000000100000001	1	010010010010000	3

FIG. 3H

0	0001000010010001	1	1000000010010001	1	0001000010010001	1	0001000010010001	1
1	0001000000001001	1	1000000000001001	1	0001000000001001	1	0001000000001001	1
2	0010000000001001	1	0010000000001001	1	0001001000000001	1	0010000000001001	1
3	0001001001000001	1	1000001001000001	1	0001001001000001	1	0001001001000001	1
4	0010010010010001	1	0010010010010001	1	0100000000001001	1	0010010010010001	1
5	0001000010010001	1	1000000010010001	1	0001000010010001	1	0001000010010001	1
6	0001000100010001	1	1000000100010001	1	0001000100010001	1	0001000100010001	1
7	0001000000100100	2	1001001000100001	1	0001000000100100	2	0001000000100100	2
8	0001000010000100	2	1000010010010001	1	0001000010000100	2	0001000010000100	2
9	0001001000010001	1	1000001000010001	1	0001001000010001	1	0001001000010001	1
10	0001001000100001	1	1000010000010001	1	0001001000100001	1	0001001000100001	1
11	0001000010010000	2	1000100100100001	1	0001000010010000	2	0001000010010000	2
12	0010000100100001	1	0010000100100001	1	0100010000100001	1	0010000100100001	1
13	0001000100000100	2	1000100010010001	1	0001000100000100	2	0001000100000100	2
14	0001000100010000	2	1000100100010001	1	0001000100010000	2	0001000100010000	2
15	0010001001000001	1	0010001001000001	1	0100010001000001	1	0010001001000001	1
16	0001000100100000	2	1001000000000001	1	0001000100100000	2	0001000100100000	2
17	0010000010010001	1	0010000010010001	1	0100100001000001	1	0010000010010001	1
18	0010000100010001	1	0010000100010001	1	0100000000000001	1	0010000100010001	1
19	0001001000000100	2	1001000010010001	1	0001001000000100	2	0001001000000100	2
20	0010001000010001	1	0010001000010001	1	0100000010010001	1	0010001000010001	1
21	0001001000010000	2	1001000100010001	1	0001001000010000	2	0001001000010000	2
22	0001001000100000	2	1001000100100001	1	0001001000100000	2	0001001000100000	2
23	0010001000100001	1	0010001000100001	1	0100000100010001	1	0010001000100001	1
24	0010010000010010	1	0010010000010010	1	0100000100100001	1	0010010000010010	1
25	0001001001000000	2	1001001000010010	1	0001001001000000	2	0001001001000000	2
26	0010000001001000	2	0010000001001000	2	0100000000100001	1	0010000001001000	2
27	0010010000100001	1	0010010000100001	1	0100001000010010	1	0010010000100001	1
28	0010000010000100	2	0010000010000100	2	0100000001000010	1	0010000010000100	2
29	0010010001000010	1	0010010001000010	1	0100001000100001	1	0010010001000010	1
30	0010010010000010	1	0010010010000010	1	0100001001000010	1	0010010010000010	1
31	0010000010010000	2	0010000010010000	2	0100000010000010	1	0010000010010000	2

FIG. 4A

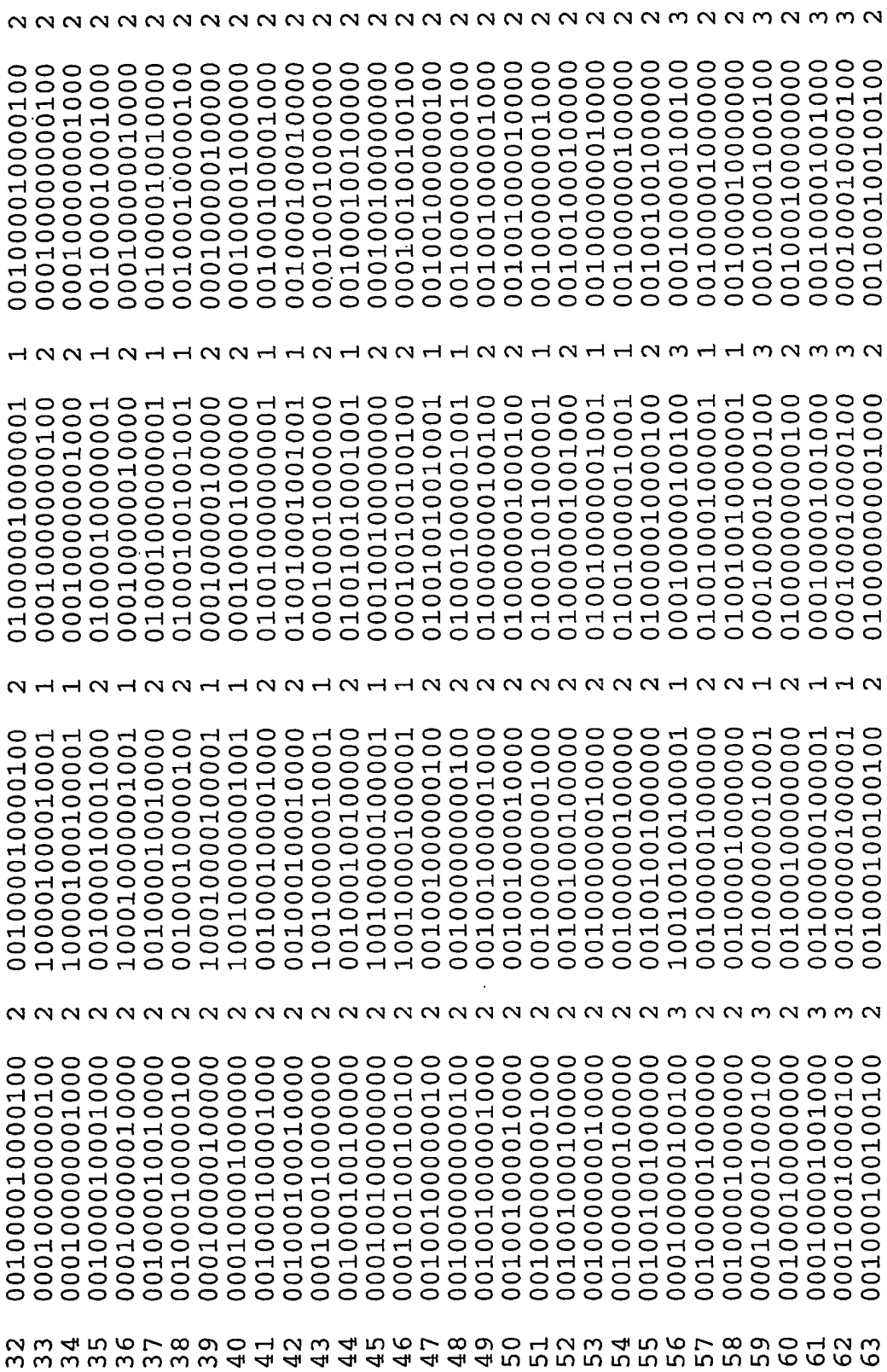

32 001000010000100 2 001000010000100 2 010000010000001 1 001000010000100 2
33 000100010000100 2 100001000010001 1 000100000000100 2 000100000000100 2
34 000100000001000 2 100001000010001 1 000100000001000 2 000100000001000 2
35 001000010001000 2 001000010000100 2 010000100000001 1 001000010001000 2
36 000100000010000 2 100010000001001 1 000100000010000 2 000100000010000 2
37 001000010010000 2 001000010000100 2 010001000000001 1 001000010010000 2
38 001000010000100 2 001000010000100 2 010001001001001 1 001000010000100 2
39 000100000100000 2 100010000100001 1 000100000100000 2 000100000100000 2
40 000100001000001 1 100100000001001 1 000100001000001 1 000100001000001 1
41 001000100001000 2 001000100001000 2 010010000000001 1 001000100001000 2
42 001000100010000 2 001000100010000 2 010010001001001 1 001000100010000 2
43 000100000100001 1 100100000100001 1 000100000100000 2 000100000100001 1
44 001000100100000 2 001000100100000 2 010010011000001 1 001000100100000 2
45 000100100000100 2 100100000100001 1 000100100000000 2 000100100001100 3
46 000100100100100 2 100100000100001 1 000100100100100 2 000100000100000 2
47 001001000000100 2 001001000000100 2 010010011000001 1 001001000000100 2
48 001000000001000 2 001000000001000 2 010001000001001 1 001000000001000 2
49 001001000001000 2 001001000001000 2 010000000100100 2 001001000001000 2
50 001001000010000 2 001001000010000 2 010000001000100 2 001001000010000 2
51 001000000001000 2 001000000001000 2 010001001000001 1 001000000001000 2
52 001001000100000 2 001001000100000 2 010000001001000 2 001001000100000 2
53 001000000100000 2 001000000100000 2 010010000001001 1 001000000100000 2
54 001000001000000 2 001000001000000 2 010010000010001 1 001000001000000 2
55 001001001000000 2 001001001000000 2 010000010000100 2 001001001000000 2
56 000100000100100 3 100100100100001 1 000100000100100 3 000100000100100 3
57 001000001000000 2 001000001000000 2 010010001000001 1 001000001000000 2
58 001000010000000 2 001000010000000 2 010010010000001 1 001000010000000 2
59 000100000100100 3 001000000010001 1 000100000100100 3 000100000100100 3
60 001000100000000 2 001000100000000 2 010000000100100 2 001000100000000 2
61 000100001001000 3 001000001000001 1 000100001001000 3 000100001001000 3
62 000100010000100 3 001000010000001 1 000100010000100 3 000100010000100 3
63 001000100100100 2 001000100100100 2 010000000001000 2 001000100100100 2

FIG. 4B

64	0001000100010000	3	0010000100000001	1	0001000100010000	3	0001000100010000	3
65	0010010001001000	2	0010010001001000	2	0100000000100000	2	0010010001001000	2
66	0010010010001000	2	0010010010001000	2	0100000001000000	2	0010010010001000	2
67	0001000100100000	3	0010001000000001	1	0001000100100000	3	0001000100100000	3
68	0010010010010000	2	0010010010010000	2	0100000010000000	2	0010010010010000	2
69	0001001000000100	3	0010010000000001	1	0001001000000100	3	0001001000000100	3
70	0001001000001000	3	1000000001001000	2	0001001000001000	3	0001001000001000	3
71	0001000000000100	3	1001000100000001	1	0001000000000100	3	0001000000000100	3
72	0001000000001000	3	1001001000000001	1	0001000000001000	3	0001000000001000	3
73	0001001000100000	3	1000000010001000	2	0001001000100000	3	0001001000100000	3
74	0001001001000000	3	1000000010010000	2	0001001001000000	3	0001001001000000	3
75	0001000000100000	3	1000000000000100	2	0001000000100000	3	0001000000100000	3
76	0010000001001000	3	0010000001001000	3	0100000100010000	2	0010000001001000	3
77	0001000001000000	3	1000000000010000	2	0001000001000000	3	0001000001000000	3
78	0001000010000000	3	1000000000100000	2	0001000010000000	3	0001000010000000	3
79	0010000010001000	3	0010000010001000	3	0100000100100000	2	0010000010001000	3
80	0001000100000000	3	1000000001000000	2	0001000100000000	3	0001000100000000	3
81	0010000010010000	3	0010000010010000	3	0100001000001000	2	0010000010010000	3
82	0010000100000100	3	0010000100000100	3	0100001000010000	2	0010000100000100	3
83	0001001001001000	3	1000000010000000	2	0001001001001000	3	0001001001001000	3
84	0010000100010000	3	0010000100010000	3	0100001000100000	2	0010000100010000	3
85	0010000000000100	3	0010000000000100	3	0100000100000000	2	0010000000000100	3
86	0010000000010000	3	0010000000010000	3	0100001000000000	2	0010000000010000	3
87	0010000100100000	3	0010000100100000	3	0100001001000000	2	0010000100100000	3
88	0010001000001000	3	0010001000001000	3	0100010000001000	2	0010001000001000	3
89	0010000000100000	3	0010000000100000	3	0100001001001000	2	0010000000100000	3
90	0010000001000000	3	0010000001000000	3	0100010001001000	2	0010000001000000	3
91	0010001000010000	3	0010001000010000	3	0100010000100000	2	0010001000010000	3
92	0010000010000000	3	0010000010000000	3	0100010010001000	2	0010000010000000	3
93	0010001000100000	3	0010001000100000	3	0100010000010000	2	0010001000100000	3
94	0010001001000000	3	0010001001000000	3	0100010001000000	2	0010001001000000	3
95	0010000100000000	3	0010000100000000	3	0100010010001000	2	0010000100000000	3

FIG. 4C

96	001000100100100	3	001000100100100	3	010010000100100	2	001000100100100	3
97	001001000000100	3	001001000000100	3	010001001000000	2	001001000000100	3
98	001001000001000	3	001001000001000	3	010010000000100	2	001001000001000	3
99	001001000100100	3	001001000100100	3	010010001000100	2	001001000100100	3
100	001001000010000	3	001001000010000	3	010010000001000	2	001001000010000	3
101	001001001000100	3	001001001000100	3	010010001001000	2	001001001000100	3
102	001001001001000	3	001001001001000	3	010010010000100	2	001001001001000	3
103	001001000100000	3	001001000100000	3	010010000010000	2	001001000100000	3
104	001001001000000	3	001001001000000	3	010010000100000	2	001001001000000	3
105	000100000000010	4	100000010000000	2	000100000000010	4	000100000000010	4
106	000100010010010	4	100000100000000	2	000100010010010	4	000100010010010	4
107	000100000010010	4	100000010000100	2	000100000010010	4	000100000010010	4
108	000100100010010	4	100000100100100	2	000100100010010	4	000100100010010	4
109	000100000100010	4	100000010001000	2	000100000100010	4	000100000100010	4
110	000100001000010	4	100000010010000	2	000100001000010	4	000100001000010	4
111	000100100100010	4	100001000100100	2	000100100100010	4	000100100100010	4
112	000100010000010	4	100000100000100	2	000100010000010	4	000100010000010	4
113	001000000000010	4	001000000000010	4	010010010001000	2	001000000000010	4
114	001000010010010	4	001000010010010	4	010010010010000	2	001000010010010	4
115	000100100000010	4	100000100001000	2	000100100000010	4	000100100000010	4
116	001000100010010	4	001000100010010	4	010000000000100	3	001000100010010	4
117	001000000010010	4	001000000010010	4	010010001000000	2	001000000010010	4
118	001000000100010	4	001000000100010	4	010010010000000	2	001000000100010	4
119	001000100100010	4	001000100100010	4	010000000001000	3	001000100100010	4
120	001001000000000	4	001001000000000	4	010000000010000	3	001001000000000	4
121	001000001000010	4	001000001000010	4	010000000100100	3	001000001000010	4
122	001000010000010	4	001000010000010	4	010000001000100	3	001000010000010	4
123	001001000010010	4	001001000010010	4	010000000100000	3	001001000010010	4
124	001000100000010	4	001000100000010	4	010000001001000	3	001000100000010	4
125	001001000100010	4	001001000100010	4	010000001000000	3	001001000100010	4
126	001001001000010	4	001001001000010	4	010000010000000	3	001001001000010	4
127	001001000000010	4	001001000000010	4	010000010000100	3	001001000000010	4

FIG. 4D

128	000000000010000	3	100000100010000	2	010000010001000	3	010001001001001	1
129	000000000100100	3	100001001000100	2	010000100100100	3	010000000000100	3
130	000000001000100	3	100001001001000	2	010001000100100	3	010000000001000	3
131	000000000100000	3	100000100100000	2	010000010010000	3	010000000100100	3
132	000000001001000	3	100010000100100	2	010001001000100	3	010000000010000	3
133	000000001000000	3	100001000000100	2	010000100000100	3	010000001000100	3
134	000000010000000	3	100001000001000	2	010000100001000	3	010000001001000	3
135	000000010000100	3	100010001000100	2	010001001001000	3	010000000100000	3
136	000000010001000	3	100010001001000	2	010010000100100	3	010000001000000	3
137	000000100100100	3	100001000010000	2	000000100100100	2	010000010000100	3
138	000001000100100	3	100001000100000	2	000001000100100	2	010000010001000	3
139	000000010010000	3	100010010000100	2	010010001000100	3	010000010000000	3
140	000001001000100	3	100001001000000	2	000001001000100	2	010000010010000	3
141	000000100000100	3	100010010001000	2	000000100000100	2	010000100100100	3
142	000000100001000	3	100010010010000	2	000000100001000	2	010001000100100	3
143	000001001001000	3	100010000000100	2	000001001001000	2	010000100000100	3
144	000000100010000	3	100100000100100	2	000000100010000	2	010001001000100	3
145	000010000100100	3	100010000001000	2	000010000100100	2	010000100001000	3
146	000010001000100	3	100010000010000	2	000010001000100	2	010000100010000	3
147	000000100100000	3	100100001000100	2	000000100100000	2	010001001001000	3
148	000010001001000	3	100010000100000	2	000010001001000	2	010000100100000	3
149	000001000000100	3	100100001001000	2	000001000000100	2	010010000100100	3
150	000001000001000	3	100100010000100	2	000001000001000	2	010010001000100	3
151	000010010000100	3	100010001000000	2	000010010000100	2	010001000000100	3
152	000010010001000	3	100010010000000	2	000010010001000	2	010001000001000	3
153	000001000010000	3	100100010001000	2	000001000010000	2	010010001001000	3
154	000001000100000	3	100100010010000	2	000001000100000	2	010000100000000	2
155	000010010010000	3	100100000000100	2	000010010010000	2	010001000010000	3
156	000001001000000	3	100100100000100	2	000001001000000	2	010000000010000	2
157	000000100100100	2	100100000001000	2	000000100100100	3	010001000100000	3
158	000001000100100	2	100100000010000	2	000001000100100	3	010001001000000	3
159	000010000000100	3	100100100001000	2	000010000000100	2	010000001000000	2

FIG. 4E

160	000010000001000	3	100100100010000	2	000010000001000	2	010000000000100	2
161	000001001000100	2	100100000100000	2	000001001000100	3	010010000000100	3
162	000001001001000	2	100100001000000	2	000001001001000	3	010010000001000	3
163	000010000010000	3	100100100100000	2	000010000010000	2	010000000001000	2
164	000010000100100	2	100100010000000	2	000010000100100	3	010010000010000	3
165	000010000100000	3	100000000000100	3	000010000100000	2	010000000100000	2
166	000010001000000	3	100000000001000	3	000010001000000	2	010000010000000	2
167	000010001000100	2	100100100000000	2	000010001000100	3	010010000100000	3
168	000010001001000	2	100100100100100	2	000010001001000	3	010010001000000	3
169	000010010000000	3	100000000010000	3	000010010000000	2	010000100100100	2
170	000000100100000	2	100000000100000	3	000000100100000	3	010001000100100	2
171	000010010000100	2	100000000100100	3	000010010000100	3	010010010000000	3
172	000001000000100	2	100000001000000	3	000001000000100	3	010001001000100	2
173	000010010001000	2	100000001000100	3	000010010001000	3	010000010001000	2
174	000010010010000	2	100000001001000	3	000010010010000	3	010000010010000	2
175	000001000001000	2	100000010000000	3	000001000001000	3	010000010001001	1
176	000000001001001	1	100000010000100	3	010000100010000	3	010000100000100	2
177	000001000010000	2	100000100100100	3	000001000010000	3	010000010010001	1
178	000001000100000	2	100001000100100	3	000001000100000	3	010000100010001	1
179	000000010001001	1	100000010001000	3	010000100100000	3	010000100001000	2
180	000001001000000	2	100001001000100	3	000001001000000	3	010010000010001	1
181	000000010010001	1	100000010010000	3	010001000000100	3	010000100010000	2
182	000000100001001	1	100000100000100	3	000000100001001	1	010000000100100	2
183	000010000000100	2	100001001001000	3	000010000000100	3	010001000001001	1
184	000010000001000	2	100010000100100	3	000010000001000	3	010001000010001	1
185	000000100010001	1	100000100001000	3	000000100010001	1	010000001001000	2
186	000000100100001	1	100000100010000	3	000000100100001	1	010000010000100	2
187	000010000010000	2	100010001000100	3	000010000010000	3	010000000000001	1
188	000001000001001	1	100000100100000	3	000001000001001	1	010000001000100	2
189	000010000100000	2	100010001001000	3	000010000100000	3	010000100001001	1
190	000010001000000	2	100010010000100	3	000010001000000	3	010010000001001	1
191	000001000010001	1	100001000000100	3	000001000010001	1	010000100100000	2

FIG. 4F

192	000010010000000	2	100010010001000	3	000010010000000	3	010000001001001	1
193	000001000100001	1	100001000001000	3	000001000100001	1	010001000000100	2
194	000001001000001	1	100001000010000	3	000001001000001	1	010001000001000	2
195	000000001000001	1	100010010010000	3	010010001001000	3	010010000100001	1
196	000010000001001	1	100001000100000	3	000010000001001	1	010000001000001	1
197	000000010000001	1	100100000100100	3	010010010000100	3	010010001000001	1
198	000000100000001	1	100100001000100	3	000000100000001	1	010010010000001	1
199	000010000010001	1	100001001000000	3	000010000010001	1	010000010000001	1
200	000010000100001	1	100010000000100	3	000010000100001	1	010000100000001	1
201	000001000000001	1	100100001001000	3	000001000000001	1	010000100100001	1
202	000001001001001	1	100100010000100	3	000001001001001	1	010001000100001	1
203	000010001000001	1	100010000001000	3	000010001000001	1	010010001001001	1
204	000010000000001	1	100100010001000	3	000010000000001	1	010000000000010	4
205	000010010000001	1	100010000010000	3	000010010000001	1	010001000000001	1
206	000000010010010	4	100010000100000	3	010001000001000	3	010010010001001	1
207	000010001001001	1	100100010010000	3	000010001001001	1	010000010010010	4
208	000000100010010	4	100010001000000	3	000000100010010	4	010010000000001	1
209	000000000010010	4	100100100000100	3	010010010001000	3	010000100010010	4
210	000000000100010	4	100100100001000	3	010010010010000	3	010000100100010	4
211	000000100100010	4	100010010000000	3	000000100100010	4	010000000010010	4
212	000000001000010	4	100100100010000	3	010000000000010	4	010001000000000	4
213	000001000000000	4	100100000000100	3	000001000000000	4	010000000100010	4
214	000001000010010	4	100100000001000	3	000001000010010	4	010000001000010	4
215	000000010000010	4	100100100100000	3	010000010010010	4	010001000010010	4
216	000000100000010	4	100000000000010	4	000000100000010	4	010001000100010	4
217	000001000100010	4	100100000010000	3	000001000100010	4	010000010000010	4
218	000001001000010	4	100100000100000	3	000001001000010	4	010000100000010	4
219	000001000000010	4	100000010010010	4	000001000000010	4	010001001000010	4
220	000010000000000	4	100100001000000	3	000010000000000	4	010001000000010	4
221	000010000000010	4	100000100010010	4	000010000000010	4	010010000000000	4
222	000010010010010	4	100000100100010	4	000010010010010	4	010010000010010	4
223	000010000010010	4	100100010000000	3	000010000010010	4	010010000000010	4

FIG. 4G

224	000010000100010	4	100100100100100	3	000010000100010	4	0100100100100	4
225	000010010001001	1	100001000000000	4	000010010001001	1	0100100001000	4
226	000010010010001	1	100001000010010	4	000010010010001	1	0100100010000	4
227	000010001000010	4	100000000010010	4	000010001000010	4	0100000000001	1
228	000000000001001	1	100001000100010	4	0100001000100	4	0100100100000	4
229	000010010000010	4	100000000100010	4	000010010000010	4	0100100100010	1
230	000000000000100	2	100000001000010	4	0100010000100	3	0100000000100	1
231	000000000010001	1	100001001000010	4	0100001001000	4	0100010010000	1
232	000000000100001	1	100010000000000	4	0100010000000	4	0100100010000	3
233	000000000001000	2	100000010000010	4	0100010001000	3	0100000001000	1
234	000000000010000	2	100000100000010	4	0100010010000	3	0100010010000	2
235	000000000100100	2	100010000010010	4	0100010000100	4	0100100100100	2
236	000000000100000	2	100001000000010	4	0100100000000	3	0100010000100	2
237	000000001000100	2	100010000100010	4	0100010001000	4	0100010010000	2
238	000000001001000	2	100010001000010	4	0100010010000	4	0100100001000	2
239	000000001000000	2	100010000000010	4	0100100000100	3	0100100000000	2
240	000000010000100	2	100010010000010	4	0100100000000	4	0100100010000	2
241	000000010000000	2	100010010010010	4	0100100000100	3	0100100000100	2
242	000000100000000	2	100100000000010	4	0000001000000	2	0100100001000	2
243	000000010001000	2	100100000010010	4	0100100000100	4	0100100010000	2
244	000000000000100	3	100100010010010	4	0100100001000	3	0100010001000	2
245	000000010010000	2	100100000100010	4	0100100001000	4	0100100100000	2
246	000000100000100	2	100100001000010	4	0000001000001	3	0100100100100	2
247	000000000001000	3	100100100010010	4	0100100010000	3	0100100100000	2
248	000100000010001	1	100100100100010	4	000100000010001	1	000100000010001	1
249	000000100001000	2	100100010000010	4	0000001000010	3	0100100100100	3
250	000000100010000	2	100100100000010	4	0000001000100	3	0100100100001	3
251	000100000100001	1	100000000010001	1	000100000100001	1	000100000100001	1
252	000100000000001	1	100000000000001	1	000100000000001	1	000100000000001	1
253	000100001000001	1	100000000100001	1	000100001000001	1	000100001000001	1
254	000100010000001	1	100000001000001	1	000100010000001	1	000100010000001	1
255	001000000000001	1	001000000000001	1	0100100010000	4	001000000000001	1

FIG. 4H

0	000100010010001	1	1000000010010001	1	000100010010001	1	000100010010001	1
1	000100000001001	1	1000000000001001	1	000100000001001	1	000100000001001	1
2	001000000001001	1	0010000000001001	1	010000000001001	1	001000000001001	1
3	000100100100001	1	1000000100100001	1	000100100100001	1	000100100100001	1
4	001001001001001	1	0010010010010001	1	010000000010001	1	001001001001001	1
5	000100001001001	1	1000000010010001	1	000100001001001	1	000100001001001	1
6	000100010001001	1	1000000100010001	1	000100010001001	1	000100010001001	1
7	000100000100100	2	1001001000100001	1	000100000100100	2	000100000100100	2
8	000100001000100	2	1000010010010001	1	000100001000100	2	000100001000100	2
9	000100100001001	1	1000001000010001	1	000100100001001	1	000100100001001	1
10	000100100010001	1	1000010000010001	1	000100100010001	1	000100100010001	1
11	000100001001000	2	1000100100100001	1	000100001001000	2	000100001001000	2
12	001000010010001	1	0010000100100001	1	010001000010001	1	001000010010001	1
13	000100010000100	2	1000100010010001	1	000100010000100	2	000100010000100	2
14	000100010001000	2	1000100100010001	1	000100010001000	2	000100010001000	2
15	001000100100001	1	0010001001000001	1	010001000100001	1	001000100100001	1
16	000100010010000	2	1001000000000001	1	000100010010000	2	000100010010000	2
17	001000001001001	1	0010000010010001	1	010010000100001	1	001000001001001	1
18	001000010001001	1	0010000100010001	1	010000000000001	1	001000010001001	1
19	000100100000100	2	1001000010010001	1	000100100000100	2	000100100000100	2
20	001000100001001	1	0010001000010001	1	010000001001001	1	001000100001001	1
21	000100100001000	2	1001000100010001	1	000100100001000	2	000100100001000	2
22	000100100010000	2	1001000100100001	1	000100100010000	2	000100100010000	2
23	001000100010001	1	0010001000100001	1	010000010001001	1	001000100010001	1
24	001001000001001	1	0010010000010001	1	010000010010001	1	001001000001001	1
25	000100100100000	2	1001001000010001	1	000100100100000	2	000100100100000	2
26	001000000100100	2	0010000001001000	2	010000000100001	1	001000000100100	2
27	001001000010001	1	0010010000100001	1	010000100001001	1	001001000010001	1
28	001000001000100	2	0010000010001000	2	010000001000001	1	001000001000100	2
29	001001000100001	1	0010010001000001	1	010000100010001	1	001001000100001	1
30	001001001000001	1	0010010010000001	1	010000100100001	1	001001001000001	1
31	001000001001000	2	0010000010010000	2	010000010000001	1	001000001001000	2

FIG. 5A

32	001000010000100	2	001000010000100	2	010000100000001	1	001000010000100	2
33	000100000000100	2	100001000010001	1	000100000000100	2	000100000000100	2
34	000100000001000	2	100001000100001	1	000100000001000	2	000100000001000	2
35	001000010001000	2	001000010001000	2	010001000000001	1	001000010001000	2
36	000100000010000	2	100010000001001	1	000100000010000	2	000100000010000	2
37	001000010010000	2	001000010010000	2	010001001001001	1	001000010010000	2
38	001000100000100	2	001000100000100	2	010010000000001	1	001000100000100	2
39	000100000100000	2	100010000100001	1	000100000100000	2	000100000100000	2
40	000100001000000	2	100100000001001	1	000100001000000	2	000100001000000	2
41	001000100001000	2	001000100001000	2	010010001001001	1	001000100001000	2
42	001000100010000	2	001000100010000	2	010010010001001	1	001000100010000	2
43	000100010000000	2	100100000010001	1	000100010000000	2	000100010000000	2
44	001000100100000	2	001000100100000	2	010010010010001	1	001000100100000	2
45	000100100000000	2	100100000100001	1	000100100000000	2	000100100000000	2
46	000100100100100	2	100100001000001	1	000100100100100	2	000100100100100	2
47	001001000000100	2	001001000000100	2	010000000100100	2	001001000000100	2
48	001000000000100	2	001000000000100	2	010001000001001	1	001000000000100	2
49	001001000001000	2	001001000001000	2	010000001000100	2	001001000001000	2
50	001001000010000	2	001001000010000	2	010000001001000	2	001001000010000	2
51	001000000001000	2	001000000001000	2	010001001000001	1	001000000001000	2
52	001001000100000	2	001001000100000	2	010000010000100	2	001001000100000	2
53	001000000010000	2	001000000010000	2	010010000001001	1	001000000010000	2
54	001000000100000	2	001000000100000	2	010010000010001	1	001000000100000	2
55	001001001000000	2	001001001000000	2	010000010001000	2	001001001000000	2
56	000100000100100	3	100100100100001	1	000100000100100	3	000100000100100	3
57	001000001000000	2	001000001000000	2	010010001000001	1	001000001000000	2
58	001000010000000	2	001000010000000	2	010010010000001	1	001000010000000	2
59	000100001000100	3	001000000100001	1	000100001000100	3	000100001000100	3
60	001000100000000	2	001000100000000	2	010000000000100	2	001000100000000	2
61	000100001001000	3	001000001000001	1	000100001001000	3	000100001001000	3
62	000100010000100	3	001000010000001	1	000100010000100	3	000100010000100	3
63	001000100100100	2	001000100100100	2	010000000001000	2	001000100100100	2

FIG. 5B

64	000100010001000	3	001000100000001	1	000100010001000	3	000100010001000	3
65	001001000100100	2	001001000100100	2	010000000010000	2	001001000100100	2
66	001001001000100	2	001001001000100	2	010000000100000	2	001001001000100	2
67	000100010010000	3	001001000000001	1	000100010010000	3	000100010010000	3
68	001001001001000	2	001001001001000	2	010000001000000	2	001001001001000	2
69	000100100000100	3	100000000100100	2	000100100000100	3	000100100000100	3
70	000100100001000	3	100000001000100	2	000100100001000	3	000100100001000	3
71	000100000000100	3	100100010000001	1	000100000000100	3	000100000000100	3
72	000100000001000	3	100100100000001	1	000100000001000	3	000100000001000	3
73	000100100010000	3	100000001001000	2	000100100010000	3	000100100010000	3
74	000100100100000	3	100000010000100	2	000100100100000	3	000100100100000	3
75	000100000010000	3	100000000000100	2	000100000010000	3	000100000010000	3
76	001000000100100	3	001000000100100	3	010000010010000	2	001000000100100	3
77	000100000100000	3	100000000001000	2	000100000100000	3	000100000100000	3
78	000100001000000	3	100000000010000	2	000100001000000	3	000100001000000	3
79	001000001000100	3	001000001000100	3	010000100000100	2	001000001000100	3
80	000100100100100	3	100000000100000	2	000100100100100	3	000100100100100	3
81	001000001001000	3	001000001001000	3	010000100001000	2	001000001001000	3
82	001000010000100	3	001000010000100	3	010000100010000	2	001000010000100	3
83	001000000000100	3	001000000000100	3	010000010000000	2	001000000000100	3
84	001000010001000	3	001000010001000	3	010000100100000	2	001000010001000	3
85	001000000001000	3	001000000001000	3	010000100000000	2	001000000001000	3
86	001000000010000	3	001000000010000	3	010000100100100	2	001000000010000	3
87	001000010010000	3	001000010010000	3	010001000000100	2	001000010010000	3
88	001000100000100	3	001000100000100	3	010001000001000	2	001000100000100	3
89	001000000100000	3	001000000100000	3	010001000100100	2	001000000100000	3
90	001000001000000	3	001000001000000	3	010001001000100	2	001000001000000	3
91	001000100001000	3	001000100001000	3	010001000010000	2	001000100001000	3
92	001000100100100	3	001000100100100	3	010001001001000	2	001000100100100	3
93	001000100010000	3	001000100010000	3	010001000100000	2	001000100010000	3
94	001000100100000	3	001000100100000	3	010001001000000	2	001000100100000	3
95	001001000100100	3	001001000100100	3	010010000100100	2	001001000100100	3

FIG. 5C

96	001001001000100	3	001001001000100	3	010010001000100	2	001001001000100	3
97	001001000000100	3	001001000000100	3	010010000000100	2	001001000000100	3
98	001001000001000	3	001001000001000	3	010010000001000	2	001001000001000	3
99	001001001001000	3	001001001001000	3	010010001001000	2	001001001001000	3
100	001001000010000	3	001001000010000	3	010010000010000	2	001001000010000	3
101	000100000000010	4	100000001000000	2	000100000000010	4	000100000000010	4
102	000100010010010	4	100000010000000	2	000100010010010	4	000100010010010	4
103	001001000100000	3	001001000100000	3	010010000100000	2	001001000100000	3
104	001001001000000	3	001001001000000	3	010010001000000	2	001001001000000	3
105	000100100010010	4	100000100000000	2	000100100010010	4	000100100010010	4
106	000100100100010	4	100000100100100	2	000100100100010	4	000100100100010	4
107	000100000010010	4	100000010001000	2	000100000010010	4	000100000010010	4
108	001000000000010	4	001000000000010	4	010010010000100	2	001000000000010	4
109	000100000100010	4	100000010010000	2	000100000100010	4	000100000100010	4
110	000100001000010	4	100000100000100	2	000100001000010	4	000100001000010	4
111	001000010010010	4	001000010010010	4	010010010001000	2	001000010010010	4
112	000100010000010	4	100000100001000	2	000100010000010	4	000100010000010	4
113	001000100010010	4	001000100010010	4	010010010010000	2	001000100010010	4
114	001000100100010	4	001000100100010	4	010000000000100	3	001000100100010	4
115	000100100000010	4	100000100010000	2	000100100000010	4	000100100000010	4
116	001001000000000	4	001001000000000	4	010000000001000	3	001001000000000	4
117	001000000010010	4	001000000010010	4	010010010000000	2	001000000010010	4
118	001000000100010	4	001000000100010	4	010000000100100	3	001000000100010	4
119	001001000010010	4	001001000010010	4	010000000010000	3	001001000010010	4
120	001001000100010	4	001001000100010	4	010000000100000	3	001001000100010	4
121	001000001000010	4	001000001000010	4	010000001000100	3	001000001000010	4
122	001000010000010	4	001000010000010	4	010000001001000	3	001000010000010	4
123	001001001000010	4	001001001000010	4	010000001000000	3	001001001000010	4
124	001000100000010	4	001000100000010	4	010000010000100	3	001000100000010	4
125	000000000100100	3	100001000100100	2	010000100100100	3	010000000000100	3
126	000000001000100	3	100001001000100	2	010001000100100	3	010000000001000	3
127	001001000000010	4	001001000000010	4	010000010001000	3	001001000000010	4

FIG. 5D

128	000000000010000	3	100000100100000	2	0100000010010000	3	0100001001001001	1
129	000000001001000	3	100001001001000	2	0100001001000100	3	0100000000010000	3
130	000000010000100	3	100010000100100	2	0100001001001000	3	0100000000100000	3
131	000000000100000	3	100001000000100	2	0100000100000100	3	0100000000100100	3
132	000000010001000	3	100010001000100	2	0100010000100100	3	0100000001000000	3
133	000000001000000	3	100001000001000	2	0100000100001000	3	0100000001000100	3
134	000000100100100	3	100001000010000	2	0000000100100100	2	0100000001001000	3
135	000000010010000	3	100010001001000	2	0100100010000100	3	0100000100100100	3
136	000000100000100	3	100010010000100	2	0000000100000100	2	0100001000100100	3
137	000001000100100	3	100001000100000	2	0000001000100100	2	0100000010000100	3
138	000001001000100	3	100001001000000	2	0000001001000100	2	0100000010001000	3
139	000000100001000	3	100010010001000	2	0000000100001000	2	0100001001000100	3
140	000001001001000	3	100010000000100	2	0000001001001000	2	0100000010010000	3
141	000000100010000	3	100010010010000	2	0000000100010000	2	0100001001001000	3
142	000000100100000	3	100100000100100	2	0000000100100000	2	0100100000100100	3
143	000010000100100	3	100010000001000	2	0000100001001000	2	0100000100000100	3
144	000001000000100	3	100100001000100	2	0000001000000100	2	0100100001000100	3
145	000010001000100	3	100010000010000	2	0000100010001000	2	0100000100001000	3
146	000010001001000	3	100010000100000	2	0000100010001000	2	0100000100010000	3
147	000001000001000	3	100100001001000	2	0000001000001000	2	0100100010001000	3
148	000010010000100	3	100010001000000	2	0000100100001000	2	0100000100100000	3
149	000001000010000	3	100100010000100	2	0000001000010000	2	0100000100000000	2
150	000001000100000	3	100100010001000	2	0000001000100000	2	0100000000010000	2
151	000010010001000	3	100010010000000	2	0000100100010000	2	0100010000000100	3
152	000010010010000	3	100100000000100	2	0000100100010000	2	0100010000001000	3
153	000001001000000	3	100100010010000	2	0000010010000000	2	0100000010000000	2
154	000010000000100	3	100100100000100	2	0000100000000100	2	0100000000000100	2
155	000000100100100	2	100100000001000	2	0000001001001000	3	0100010000100000	3
156	000010000001000	3	100100100001000	2	0000100000001000	2	0100000000001000	2
157	000001000100100	2	100100000010000	2	0000010001001000	3	0100010001000000	3
158	000001001000100	2	100100000100000	2	0000010010001000	3	0100010010000000	3
159	000010000010000	3	100100100010000	2	0000100000100000	2	0100000001000000	2

FIG. 5E

160	000010000100000	3	100100100100000	2	000010000100000	2	010000010000000	2
161	000001001001000	2	100100001000000	2	000001001001000	3	010010000000100	3
162	000010000100100	2	100100010000000	2	000010000100100	3	010010000001000	3
163	000010001000000	3	100000000000100	3	000010001000000	2	010000100100100	2
164	000010001000100	2	100100100000000	2	000010001000100	3	010010000010000	3
165	000000100100000	2	100000000001000	3	000000100100000	3	010001000100100	2
166	000001000000100	2	100000000010000	3	000001000000100	3	010001001000100	2
167	000010001001000	2	100100100100100	2	000010001001000	3	010010000100000	3
168	000010010000100	2	100000000100100	3	000010010000100	3	010010001000000	3
169	000001000001000	2	100000000100000	3	000001000001000	3	010000010001001	1
170	000001000010000	2	100000001000000	3	000001000010000	3	010000010010001	1
171	000010010001000	2	100000001000100	3	000010010001000	3	010000010001000	2
172	000001000100000	2	100000100100100	3	000001000100000	3	010000100010001	1
173	000010010010000	2	100000001001000	3	000010010010000	3	010000010010000	2
174	000000001001001	1	100000010000100	3	010000100010000	3	010000100000100	2
175	000001001000000	2	100001000100100	3	000001001000000	3	010010000010001	1
176	000000010001001	1	100000010001000	3	010000100100000	3	010000100001000	2
177	000010000000100	2	100001001000100	3	000010000000100	3	010001000001001	1
178	000010000001000	2	100001001001000	3	000010000001000	3	010001000010001	1
179	000000010010001	1	100000010010000	3	010001000000100	3	010000100010000	2
180	000010000010000	2	100010000100100	3	000010000010000	3	010000000000001	1
181	000000100001001	1	100000100000100	3	000000100001001	1	010000000100100	2
182	000000100010001	1	100000100001000	3	000000100010001	1	010000001001000	2
183	000010000100000	2	100010001000100	3	000010000100000	3	010000100001001	1
184	000010001000000	2	100010001001000	3	000010001000000	3	010010000001001	1
185	000000100100001	1	100000100010000	3	000000100100001	1	010000010000100	2
186	000001000001001	1	100000100100000	3	000001000001001	1	010000001000100	2
187	000010010000000	2	100010010000100	3	000010010000000	2	010000001001001	1
188	000001000010001	1	100001000000100	3	000001000010001	1	010000100100000	2
189	000000001000001	1	100010010001000	3	010010001001000	3	010010000100001	1
190	000000010000001	1	100010010010000	3	010010010000100	3	010010001000001	1
191	000001000100001	1	100001000001000	3	000001000100001	1	010001000000100	2

FIG. 5F

192	0000001000000001	1	1001000001001000	3	0000001000001000	1	0100100100000001	1
193	0000010010000001	1	1000010000100000	3	0000010010001000	1	0100010000010000	2
194	0000010000010001	1	1000010001000001	3	0000010000100001	1	0100000100100001	1
195	0000010000000001	1	1001000010000100	3	0000010000001000	1	0100001001000001	1
196	0000010000010001	1	1000010010000100	3	0000010000010001	1	0100001000000000	4
197	0000010010001001	1	1001000100100100	3	0000010010001001	1	0100000000100010	4
198	0000010000000001	1	1001000100000100	3	0000010000000001	1	0100001000100010	4
199	0000010000100001	1	1000010000000100	3	0000010000100001	1	0100010000000001	1
200	0000010001000001	1	1000100000001000	3	0000010001000001	1	0100010001001001	1
201	0000010001001001	1	1001000100010000	3	0000010001001000	1	0100000100100010	4
202	0000000000010010	4	1001000100100000	3	0100100100010000	3	0100001001000010	4
203	0000100100000001	1	1000100000010000	3	0000100100000001	1	0100010000000001	1
204	0000000001000010	4	1001001000001000	3	0100100100000010	3	0100000100100010	4
205	0000000100100010	4	1000100010000100	3	0100001000001000	3	0100100001001001	1
206	0000001000010010	4	1000100010000000	3	0000000100100010	4	0100010000000001	1
207	0000000010000010	4	1001001000001000	3	0100000000000010	4	0100001000000000	4
208	0000001001000010	4	1001000000001000	3	0000001001000010	4	0100000000010010	4
209	0000001000000010	4	1001001000010000	3	0100000100100010	4	0100010000000010	4
210	0000001000000010	4	1001001001000000	3	0000001000000010	4	0100010001001000	4
211	0000010000001000	4	1001000000001000	3	0000001000000000	4	0100000001000010	4
212	0000010000000010	4	1000000000000010	4	0000010000000010	4	0100001001000010	4
213	0000010000100010	4	1001000000010000	3	0000010000100010	4	0100000001000010	4
214	0000010001000010	4	1001000001000000	3	0000010001000010	4	0100000100000010	4
215	0000010000000010	4	1000000100100010	4	0000010000100010	4	0100100001000010	4
216	0000010010010010	4	1000001000100010	4	0000010010000010	4	0100100001000010	4
217	0000010010000010	4	1001000010000000	3	0000010010000010	4	0100001000000010	4
218	0000010000010010	4	1001001001001000	3	0000010000010010	4	0100010000000010	4
219	0000010010001001	1	1000001000100010	4	0000010010001001	1	0100100001000010	4
220	0000010000100010	4	1000000000010010	4	0000010000100010	4	0100010000000010	4
221	0000010010010001	1	1000010000000000	4	0000010010010001	1	0100100100000010	4
222	0000000000001001	1	1000010000100010	4	0100010010010010	4	0100100100000001	1
223	0000100010000010	4	1000000001000010	4	0000100010000010	4	0100100100010010	4

FIG. 5G

224	000010010000010	4	100000001000010	4	000010010000010	4	010000000001001	1
225	000000000010001	1	100001000100010	4	010000100100010	4	010010010001000	3
226	000000000100001	1	100001001000010	4	010001000000000	4	010010010010000	2
227	000000000000100	2	100000010000010	4	010001000010000	3	010010010010001	1
228	000000000100100	2	100010000010010	4	010001000010010	4	010001001001000	2
229	000000000001000	2	100000100000010	4	010001000100000	3	010000000010001	1
230	000000000010000	2	100001000000010	4	010001001000000	3	010000000100001	1
231	000000001000100	2	100010000100010	4	010001000100010	4	010010000100100	2
232	000000001001000	2	100010001000010	4	010001001000010	4	010010001000100	2
233	000000000100000	2	100010000000010	4	010010000000100	3	010001001000000	2
234	000000001000000	2	100010010010010	4	010010000001000	3	010001000010000	2
235	000000010000100	2	100010010000010	4	010010000010010	4	010010001001000	2
236	000000010000000	2	100100000000010	4	010010000010000	3	010010000000100	2
237	000000010001000	2	100100000010010	4	010010000100010	4	010010010000100	2
238	000000010010000	2	100100000100010	4	010010001000010	4	010010010001000	2
239	000000100000000	2	100100010010010	4	000000100000000	2	010010000010000	2
240	000000100000100	2	100100001000010	4	000000100000100	3	010010010010000	3
241	000000000000100	3	100100100010010	4	010010000100000	3	010010000100000	2
242	000000000001000	3	100100100100010	4	010010001000000	3	010001000100000	2
243	000000100001000	2	100100010000010	4	000000100001000	3	010010010000100	3
244	000100000010001	1	100000000010001	1	000100000010001	1	000100000010001	1
245	000000100010000	2	100100100000010	4	000000100010000	3	010010010000000	2
246	000100000000001	1	100000100010001	1	000100000000001	1	000100000000001	1
247	000100000100001	1	100000000100001	1	000100000100001	1	000100000100001	1
248	000100001000001	1	100000001000001	1	000100001000001	1	000100001000001	1
249	001000000000001	1	001000000000001	1	010010010000010	4	001000000000001	1
250	001000000100001	1	100001001000001	1	010000000100010	4	010010000001000	2
251	000100010000001	1	100000010000001	1	000100010000001	1	000100010000001	1
252	001000001000001	1	100010000010001	1	010000001000010	4	010010001000000	2
253	000100100000001	1	100000100000001	1	000100100000001	1	000100100000001	1
254	001000000010001	1	001000000010001	1	010000000010010	4	001000000010001	1
255	001000010000001	1	100010001000001	1	010000010000010	4	001000000100001	1

FIG. 5H

INTERNATIONAL SEARCH REPORT

Int onal Application No
PCT/EP 01/05505

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H03M5/14 G11B20/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 . H03M G11B H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 151 699 A (MORIYAMA YOSHIAKI) 29 September 1992 (1992-09-29) abstract figures 2,3 column 3, line 49 -column 4, line 45	1,3, 11-14
Y	WO 99 33183 A (SONY CORP ;KONINKL PHILIPS ELECTRONICS NV (NL)) 1 July 1999 (1999-07-01) the whole document	1,3, 11-14
A	WO 99 35747 A (KAHLMAN JOSEPHUS A H M ;KONINKL PHILIPS ELECTRONICS NV (NL); PHILI) 15 July 1999 (1999-07-15) page 2, line 3 -page 3, line 18 page 4, line 15 -page 8, line 19 figure 1	1-3, 11-14

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 September 2001	28/09/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Ogor, M

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

In ›nal Application No
PCT/EP 01/05505

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	WO 97 09718 A (PHILIPS ELECTRONICS NV ;PHILIPS NORDEN AB (SE)) 13 March 1997 (1997-03-13) cited in the application the whole document	1,2,4-8, 11-14

INTERNATIONAL SEARCH REPORT

Int ɔnal Application No
PCT/EP 01/05505

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 5151699	A	29-09-1992	JP	2045417 C	09-04-1996
			JP	4115751 A	16-04-1992
			JP	7079359 B	23-08-1995
WO 9933183	A	01-07-1999	AU	1256499 A	12-07-1999
			BR	9807593 A	22-02-2000
			CN	1252906 T	10-05-2000
			EP	0962058 A1	08-12-1999
			HU	0003771 A2	28-02-2001
			WO	9933183 A1	01-07-1999
			TR	9902381 T1	21-07-2000
			US	6175318 B1	16-01-2001
			US	6275175 B1	14-08-2001
WO 9935747	A	15-07-1999	EP	0965172 A2	22-12-1999
			WO	9935747 A2	15-07-1999
			US	6265994 B1	24-07-2001
WO 9709718	A	13-03-1997	AT	201527 T	15-06-2001
			AU	703791 B2	01-04-1999
			AU	6666796 A	27-03-1997
			CA	2205565 A1	13-03-1997
			CN	1166225 A	26-11-1997
			DE	69612955 D1	28-06-2001
			EP	0789910 A1	20-08-1997
			HU	9801354 A2	28-10-1998
			WO	9709718 A1	13-03-1997
			IL	120740 A	26-07-2000
			JP	10508456 T	18-08-1998
			PL	320006 A1	01-09-1997
			TW	394931 B	21-06-2000
			US	5790056 A	04-08-1998